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SMART IRRIGATION METHODOLOGY FOR THE ECONOMIC GROWTH OF FARMERS

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Abstract— **Agriculture is the backbone for the economic growth of any country. But even in the developing countries like our India, traditional forming methods are adopted by our rural farmers. These methods require high man power, more time, regular monitoring and control throughout the entire agricultural process. Because of globalization and the developments happened in digitalization and communication, more and more research works are carried out to make these agricultural process SMART. In this article, it is proposed to implement a smart irrigation system for corps using digital components. The moisture sensors kept at different locations of the farm yard senses and gives signals to Arduino controller continuously. Based upon the pre-defined moisture level set in the controller, the controller actuates the water supply system to effectively distribute the water at the required locations. This system reduces the excess water supplied to the corps during the irrigation process and increases the life of corps by maintaining the safety water level. A set of solar Photovoltaic cells are used for power generation. A message about the ON/OFF status of the water pump will be sent to the farmer through the registered mobile number using GSM module. This is an automatic irrigation system that uses water more economically and also increases productivity of the corps.**

Keywords— **Irrigation system, agriculture methods, smart methodologies, digital components**

I. INTRODUCTION

Water is an essential resource for the development of all communities. Effective use of water is very important in present water crisis scenario. Majority of the farmers using traditional farming approaches depend on man power. For neglecting this approach, we are planning to propose water management System using Arduino, which automatically supplies sufficient quantity of water to plants and keep updating by sending message to mobile phone. In This System, Soil Moisture Sensor checks the moisture level in the soil and if moisture level is low then Arduino switches on a water pump to provide sufficient quantity of water to the plant. Water pump gets automatically off when system senses enough moisture in the soil. Through this system, we make effective and proper utilization of water to crops and reduces excess water supply.

Whenever this proposed system switching ON or OFF the pump, a message will be sent to the user containing the status of water pump and soil moisture via GSM module, updating. This system is very useful in farms, gardens, etc. It is fully automated and there is no necessity for any human involvement. Global system for mobile communication (GSM) is one of the most trustable wireless communication systems that can be easily accessed and used very easily. The price of the GSM module is less so it is very cost efficient also.

Irrigation of plants is usually a very time- consuming activity, to be done in a reasonable amount of time, it requires a large amount of human resources. Traditionally all the steps were executed by humans. Nowadays new systems use recent technologies to reduce the number or workers or the time required to water the plants. Using such systems, the control is very restricted, and many resources are still unexploited.

Water is one of these resources that are used excessively. This method represents massive losses since the amount of water given is in excess of the plant's needs. The excess water is evacuated by the holes of the pots in greenhouses, or it percolates through the soil in the fields. The modern perception of water is that of a free non-conventional resource that can be used in abundance. So, a period of short time, water will bey expensive resource everywhere.

In addition to the excess cost of labour is becoming more and more expensive. As a result, if no effort is invested in optimising these resources, there will be more money involved in the same process. This technology is probably a solution to reduce costs and prevent loss of resource, this system can be a strong way to tackle such a situation.

The water management system shows a well-established combination of Arduino Uno, Soil Moisture Sensor, Water Pump and their interconnection.

This system has been designed to achieve the following properties:

- ✓ To increase the production by using better irrigation system.

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- ✓ To manage the water supply for proper cultivation of plants.
- ✓ To reduce man power.
- ✓ To take proper action regarding the condition of the soil through the proposed system.

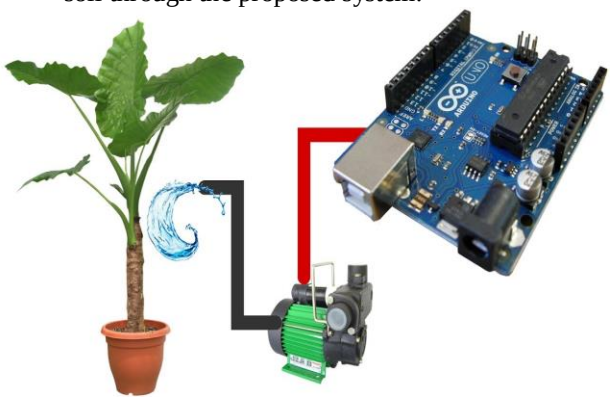

Fig. 1. Schematic diagram of the Smart Irrigation Methodology

II. DESIGN METHODOLOGY

In this system GSM, Soil moisture sensor, and water pump are connected into the Arduino pins. LCD display shows the condition of soil and water pump. SMS is send to the user by using GSM about the condition of soil moisture level and water pump is switched ON/OFF. TXD pin of GSM is connected to 8th pin of Arduino. RXD pin of GSM is connected to 9th pin of Arduino. GSM GND pin is connected to Arduino GND pin. GSM is powered by a 12-volt battery through power cable. The power cable is connected to the DC power jack provided on the GSM board. A SIM is inserted on the slot provided on the GSM board. VOC pin of soil moisture sensor is connected to Arduino 5V pin. GND pins of soil moisture sensor and Arduino are connected. A0 pins of Arduino and Soil moisture sensor are connected. Potentiometer of moisture sensor is adjusted to get accurate moisture level. Relays are used to control the water pump. Relay has five pins. Pin 1 and 2 are coil terminals, pin 3 is N/O contact, pin 4 is N/C contact, and pin 5 is movable contact. Relay pin 1 is connected to Arduino digital pin 13. Relay pin 2 is connected to Arduino GND pin. Relay pin 3(N/O) is connected to positive terminal of water pump. Negative terminal of water pump is connected to negative terminal of rechargeable battery. Relay pin 5 is connected to positive terminal of rechargeable battery.

The LCD display has 16 pins; these pins are connected Arduino board. A 10k potentiometer is used to adjust the brightness level of LCD Display. 200-ohm resistor is also used. VSS pin of LCD is connected to Arduino GND pin. VDD pin of LCD is connected to Arduino 5-v pin. Potentiometer has three pin. Pin 1 is VCC, pin 2 is output and pin 3 is GND. V0 pin of LCD is connected to potentiometer output pin. RS pin of LCD is connected to Arduino digital pin 12. RW pin of LCD is connected to Arduino GND pin. E pin of LCD is connected to Arduino digital pin 11. D4 pin of LCD is connected to Arduino digital pin 5. D5 pin of LCD is connected to Arduino digital pin 4. D6 pin of LCD is connected to Arduino digital pin 3. D7 pin of LCD is connected to Arduino digital pin 2. Resistor has two pins. A pin of LCD is connected to resistor pin 2. K pin of LCD is connected to resistor pin 1. Resistor pin 1 is connected to Arduino 5V pin.

The Arduino IDE software is used to write and load programs on Arduino UNO board. When the program is loaded into the Arduino, the soil moisture sensor senses the water content in the soil, if moisture level is low then Arduino switches on a water pump to provide water to the plant. Water pump switched to be automatically off when system finds sufficient moisture in the soil. Whenever system interchanged to be ON or OFF the pump, a message will be send to the end user via GSM module, apprising the current status of water pump and soil moisture. The entire system works by using solar energy. Hence it does not harmful to the environment and reduces electricity charges.

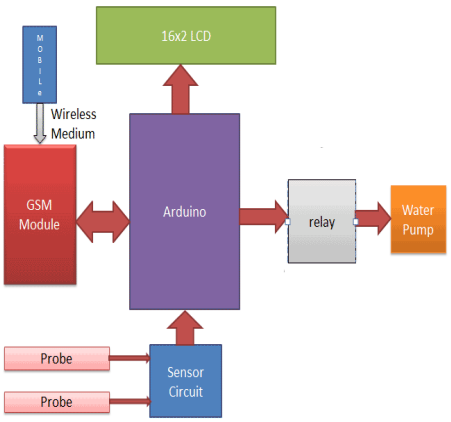

Fig. 2. Block diagram for the Smart Irrigation

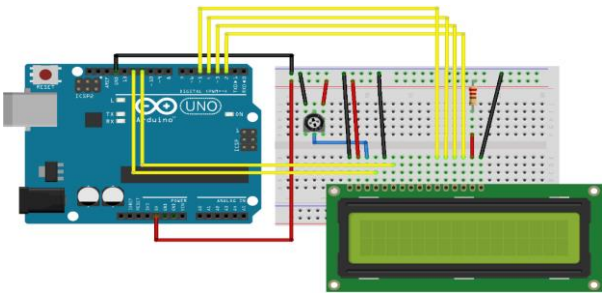

Fig. 3. Arduino and LCD display circuit diagram

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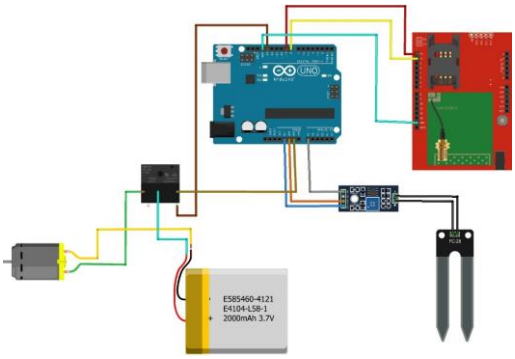

Fig. 4. Arduino, GSM, and water pump circuit diagram

III. SMART IRRIGATION

With the recent technological advancements, it is necessary to increase the annual crop production output entirely agro-centric economy and also to save farmers effort, water and time. The ability to conserve the natural resources as well as giving a splendid boost to the production of the crops is one of the main aims of incorporating such technology into the agricultural domain of the country.

Irrigation management is a complex decision making process to find when and how much water to apply to a growing crop to meet specific management objectives. If the user is so far from the agricultural land he will not be known of current soil conditions. So, efficient water management system plays a vital role in the Irrigated agricultural cropping systems.

In this proposed System, Soil Moisture Sensor checks the quantity of moisture level in the soil and if moisture level is low then Arduino switches ON a water pump to provide sufficient water to the plant. Water pump gets automatically OFF when system determines required moisture in the soil. Whenever system switching ON or OFF the pump, a message will be grasp by the user via GSM module, updating the status of water pump and soil moisture and it is also shown in LCD display. This system is very useful in gardens, farms, home etc.

The Arduino programming will be done by the Arduino IDE software. The soil moisture sensor is connected to the Arduino pins. The moisture sensor checks and measures the level of moisture in the agricultural soil and sends signal to the Arduino for further processing of watering if it is required. The water pump supplies water to the plants until the desired moisture level is required. GSM module sends information about the soil moisture and condition of motor pump through SMS to the user. Water pump is worked with the help of solar energy and it is stored in a rechargeable battery. The sun ray's fall on the solar panel is converted into electricity by photovoltaic effect. It provides power supply to the entire system including GSM and Arduino.

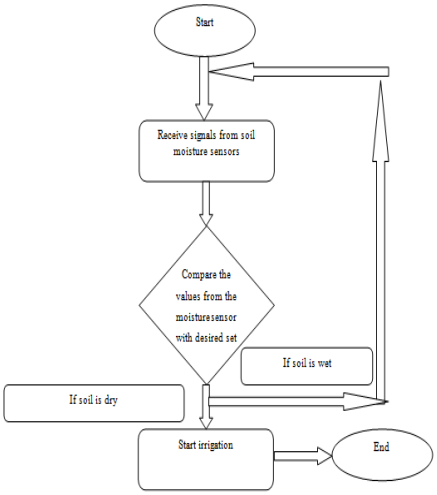

Fig. 5. Flow diagram of the Smart Irrigation Methodology

IV. CONCLUSION

This irrigation management system is a complex decision making process to determine how much water is applied to a growing crop to meet efficient crop production. If the farmer is so far from the cultivating land he will be unaware of current soil conditions. So, efficient water management plays a significant role in the irrigation systems.

The Arduino based automatic irrigation system is a very simple method and also precise way of irrigation. Hence, this system is very useful as it reduces manual supervision of the farmers, eliminates the manual switching ON/OFF for the water pump and also helps in the proper utilization of resources (water and solar). This proposal can be extended to create fully automated gardens and farm lands by using this principle in the right manner on large scale.

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